NAS EIC Panel Members
Biographical Notes

Ani Aprahamian (Notre Dame - *co-chair*)

http://physics.nd.edu/people/faculty/ani-aprahamian/

Ani's research focuses on the evolution of nuclear structure and the impact of various structure effects on stellar and explosive astrophysical processes. In nuclear structure, the onset of deformation and the viability of collective excited motion is a point of focus for her work. While the effects of nuclear structure in nuclear masses, nuclear shapes, decay lifetimes, and probabilities are explored in terms of how they influence heavy element nucleosynthesis and the elemental abundances for the rapid neutron capture process. This research is a part of the NSF physics frontier center JINA-CEE (Joint Institute of Nuclear Physics Center for the Evolution of the Elements). Experiments are carried out at the Nuclear Science Laboratory at Notre Dame as well as a number of facilities worldwide, including CARIBU at ANL, the NSCL at MSU, at Jyvakyla in Finland, at Triumf in Canada, and RIKEN in Japan. She has over 160 invited talks at various National and International Conferences and over 150 publications in refereed journals, book chapters, etc. She is active in numerous international and national advisory committees in nuclear science. She is the JINA representative to EMMI (Extreme Matter Institute: Helmholtz Center of Excellence) at GSI. She has served as chair of the scientific council at GANIL in France and as reviewer for the Institute of Physics in the UK.

Gordon Baym (UIUC - *co-chair*)

https://physics.illinois.edu/people/directory/profile/gbaym

Gordon received his bachelor's degree in physics from Cornell University in 1956, his A.M. in mathematics from Harvard in 1957, and his Ph.D. in physics from Harvard in 1960. He joined the Department of Physics at the University of Illinois as an assistant professor in 1963. Professor Baym has been a major leader in the study of matter under extreme conditions in astrophysics and nuclear physics. He has made original, seminal contributions to our understanding of neutron stars, relativistic effects in nuclear physics, condensed matter physics, quantum fluids, and most recently, Bose-Einstein condensates. His work is characterized by a superb melding of basic theoretical physics concepts, from condensed matter to nuclear to elementary particle physics. After originally pioneering the application of field-theory methods in quantum condensed matter systems, he turned to problems of neutron stars, elucidating the nuclear physics of neutron stars' crusts, neutron star structure and their formation in supernovae explosions. His studies of the unusual states of matter in the deep interiors of neutron stars were seminal—first on the fundamental nature of the pion condensed state of neutron star matter and then on the physics of quark matter and the quark-gluon plasma. With the realization that further progress in the physics of matter under extreme conditions would require dedicated laboratory experiments, he was an early advocate for and has taken a leadership role in the current international effort to use ultrarelativistic heavy-ion collisions to test experimentally the behavior of matter under extreme conditions. He has been particularly instrumental in establishing the relativistic heavy ion collider (RHIC) project at Brookhaven National Laboratory, which, when completed, will collide subatomic particles at energies of 100 GeV. At the same time, he has made fundamental contributions to understanding the physics of ultrarelativistic heavy-ion collisions. In addition to his contributions to astrophysics and nuclear theory, Gordon has had an early and continuing influence on theoretical condensed matter physics, most recently on the physics of Bose-Einstein condensed atomic systems.

Christine Aidala (U Michigan)

http://www-personal.umich.edu/~caidala/

Christine does research at the boundary of nuclear and particle physics, studying nucleon structure and parton dynamics in QCD. She has been on the PHENIX experiment at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory since 2001 and on the E906/SeaQuest experiment at Fermilab since 2010. She joined the faculty of the University of Michigan in 2012.
She also does work on the foundations of physics and is currently collaborating with others on a project to derive the standard mathematical frameworks for Hamiltonian and Lagrangian mechanics from physical assumptions.

Haiyan Gao (Duke U)

https://www.phy.duke.edu/content/haiyan-gao

Haiyan's research focuses on understanding the structure of the nucleon in terms of quark and gluon degrees of freedom of Quantum Chromodynamics (QCD), the search for QCD exotics, and fundamental symmetry studies at low energy to search for new physics beyond the Standard Model of electroweak interactions. Most of her work utilizes the novel experimental technique of scattering polarized electrons or photons from polarized gas targets. Her group has built a number of state-of-the-art polarized gas targets including H/D internal gas target and a high-pressure polarized 3He target for photon experiments using the High Intensity Gamma Source (HIGS) facility at the Duke Free Electron Laser Laboratory (DFELL). Currently, her group and collaborators from Indiana University are also employing such a high-pressure, thin-window polarized 3He target in a new search for spin-dependent short-range forces. She and her group are also collaborating on a challenging experiment aiming at a major improvement over the current limit on the neutron electric dipole moment. Such an experiment will make important contributions to the understanding of CP violation and to the search of New

Physics beyond the Standard Model. Her research is being carried out at Duke University, the Jefferson Lab, the HIGS facility at DFELL, and the Fundamental Neutron Beam Line at the Spallation Neutron Source at the ORNL. Since 2 years, Haiyan has also been leading the academic program of Duke-Kunshan University in Kunshan (China) as Vice Chancellor for Academic affairs.

Kawtar Hafidi (ANL)

https://www.phy.anl.gov/mep/staff/Hafidi_K.html

Kawtar's research area is the experimental study of Quantum Chromo-Dynamics (QCD) in the strong (non-perturbative) regime, including nucleon structure in QCD (Nucleon form factors, flavor decomposition, spin structure, transverse momentum dependent distributions and charge symmetry), and nuclear QCD **(**Parton energy loss, hadron formation, three-dimensional imaging of nucleons and nuclei, color transparency and nuclear modification effects). The majority of her work is performed in Hall B at Jefferson Lab, though she has also been involved in Hall C and Hall A experiments, as well as experiments at HERMES at DESY and Fermilab.

Larry McLerran (INT / U Washington)

https://www.bnl.gov/physics/NTG/people/mclerran.php

Larry's research is on the theory of matter at very high energy density. He was one of the first to propose that high energy heavy ion collisions might make a Quark Gluon Plasma, and showed how this might happen using Bjorken's space-time picture of hadronic collisions. He did the first Monte Carlo simulation of high temperature QCD and showed that there is a de-confining phase transition. He also did seminal work on baryon number violation in electroweak theory. With various collaborators he invented the idea of the Color Glass Condensate, the matter that controls the high energy limit of QCD and expanded this idea into the concept the Glasma, matter that makes the transition between the the Color Glass Condensate and the Quark Gluon Plasma in collisions of strongly interacting particles. I am now working on the properties of the Glasma, how it thermalizes and the possibility that it may form gluons Bose condensates

Zein-Eddine Meziani (Temple U)

https://phys.cst.temple.edu/~meziani/

The overarching goal of Zein-Eddine's research is to understand the structure of nucleons, the building blocks of nuclei, in terms of their constituents called quarks and gluons. The fundamental properties of the nucleon such as its mass, charge and spin are investigated within the theory of "strong" interactions known as Quantum Chromodynamics (QCD). QCD describes, from basic principles, the complex nature of the interactions (known as color interactions) among the nucleon's constituents. The Temple University Nuclear Physics Group is engaged in a series of experiments that aim at addressing the following science questions of nucleon/hadron structure: Is the nucleon modified in the nuclear medium and if so how? What is the size of the average "strong" (color) force a valence quark feels when it starts its journey leaving the nucleon to become a hadron? How much of the valence quarks orbital motion contribute to the total "spin" half of the nucleon and how is this contribution distributed for each longitudinal momentum of these quarks? How much of the proton mass is carried by the mass, kinetic and potential energy of the quarks, the kinetic and potential energy of the gluons and a fundamental piece known as the "trace anomaly"? How are the quark and gluon density distributions of a free nucleon different from that of a nucleon embedded in a nucleus? The research to answer these questions includes analysis of Jefferson Lab 6 GeV era experiments as well as simulations, design, R&D of detector components for the new CLAS-12, Super High Momentum Spectrometer (SHMS) experiments and the longer-term SoLID experiment.

Richard Milner (MIT)

http://web.mit.edu/physics/people/faculty/milner_richard.html

Richard is a member of Laboratory for Nuclear Science's Hadronic Physics Group. His research is focused on studying the spin structure of strongly interacting systems. A major focus of his research effort over the last decade has been the HERMES experiment to study the spin structure of the nucleon. HERMES has provided important new data on the flavor decomposition of the quark spin and on the contribution of the glue, yielding a number of new, unexpected results. One of his most recent efforts was at the MIT Bates Linear Accelerator Center, where the construction of a new large detector called the "Bates Large Acceptance Spectrometer Toroid" (BLAST) was completed. BLAST was used with the stored polarized beam to measure spin-dependent electron scattering from polarized hydrogen, deuterium and He-3 targets and provided important information on the spin structure of light nuclei as well as on the neutron form-factors. He joined the MIT faculty in 1988, where he served as Director of the Bates Linear Accelerator Center, and Director of MIT's Laboratory for Nuclear Science.

Ernst Sichtermann (LBNL)

http://hepg.sdu.edu.cn/THPPC/files/sichtermann-cv.pdf

Ernst is a senior staff member in the Nuclear Science Division of LBNL. He primary research area has been spin physics with the STAR experiment at BNL. He is a co-convenor of spin physics in the STAR collaboration and of the Working Group on ep physics in the EIC Users Group. He is currently a Deputy spokesperson of the STAR collaboration. Ernst previously worked on the muon g-2 experiment at BNL.

Peter Braun-Munzinger (GSI - *heavy ion physics*)

http://web-docs.gsi.de/~pbm/

Peter main research has been on relativistic heavy ion physics. As a faculty member of SUNY Stony Brook he performed fixed target experiments with heavy ions at the AGS. After moving to GSI and the TU Darmstadt he led the German participation in the ALICE experiment at the LHC. Most recently he served as the Director of the Extreme Matter Institute (EMMI) at GSI.

Wick Haxton (UC Berkeley - *neutrino physics*)

http://physics.berkeley.edu/people/faculty/Wick-Haxton

Wick received his Ph.D. from Stanford in 1976. He spent most of his early research career in the Los Alamos Theory Division, where he was a J. Robert Oppenheimer Fellow and later a staff member. He moved to the University of Washington in 1984 as Professor and, for 15 years, Director of the Department of Energy's Institute for Nuclear Theory. In 2009 he joined UC Berkeley as Professor of Physics and Lawrence Berkeley Laboratory as Senior Faculty Scientist. His research interests include neutrino physics, nuclear astrophysics, tests of fundamental symmetries, and many-body theory. He is a member of the National Academy of Sciences and a Fellow of the American Academy of Arts and Sciences, the Washington State Academy of Sciences, the American Association for the Advancement of Science, and the American Physical Society. Wick received the Hans Bethe Prize from the APS in 2004.

John Jowett (CERN - *accelerator science*)

http://jowett.web.cern.ch/jowett/

John is an accelerator physicist at CERN. His principal activity is with heavy ion beams, especially Pb-Pb and p-Pb collisions, in the LHC. He has been elected as a Fellow of the APS "For groundbreaking contributions to the design and commissioning of particle colliders, in particular for the mathematical modeling of electron beams in storage rings, for developing an operation scheme with a large number of bunches in LEP, for the design of tau-charm factories, and for the use of the LHC as a lead-lead and proton-lead collider."

Thomas Schaefer (NC State - *many-body physics & QCD*)

https://www.physics.ncsu.edu/people/faculty_schaefer.php

Thomas received his PhD in 1992 from the University of Regensburg (Germany). From 1992-1998 he held postdoctoral positions at the State University of New York at Stony Brook and the National Institute for Nuclear Theory at the University of Washington.

From 1998-1999 he was a member of the Institute for Advanced Study in Princeton before joining the Faculty at Stony Brook as an Assistant Professor in 2000. He joined the faculty of North Carolina State University in 2003. From 2000-2004 he was also a fellow at the RIKEN-BNL Research Center at Brookhaven National Laboratory.
Schaefer studies Quantum hromodynamics (QCD) and the behavior of matter under extreme conditions. This includes the behavior of matter at very high temperature ($T>10^{10}$ Kelvin), which is relevant to the very early Universe and to high energy collisions of Heavy Ions, as well as matter at low temperature but density in excess of 10^{14} grams/cm^3, which occurs in compact stars. He is known for his study of topological objects (instantons) in QCD, his work on color superconductivity in quark matter, and his work on effective theories of dense matter.

Michael Turner (U Chicago - *cosmology*)

https://en.wikipedia.org/wiki/Michael_Turner_(cosmologist)

Mike is a theoretical cosmologist at the University of Chicago, who coined the term *dark energy* in 1998. He was formerly the Assistant Director for Mathematical and Physical Sciences for the US National Science Foundation from 2003–2006. His book *The Early Universe*, co-written with fellow Chicago cosmologist Rocky Kolb and published in 1990, is a standard text on the subject. He earned a PhD in Physics from Stanford University in 1978. He helped establish the interdisciplinary field that combines together cosmology and elementary particle physics to understand the origin and evolution of the Universe. His research focuses on the earliest moments of creation, and he has made contributions to inflationary cosmology, particle dark matter and structure formation, the theory of big bang nucleosynthesis, and the nature of dark energy.
The National Academy study, *Connecting quarks with the cosmos: Eleven science questions for the new century*, which he chaired, identified opportunities at the intersection of Astronomy and Physics and has help shape science investment in the US in this area.